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# A Study on Selections of Strategic Type of Business in Air-logistics Industry Clusters

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Contents



**Abstract**

The main object of this research is to select strategic type of business to build an air-logistics cluster by analyzing the effects and mutual relationship among logistics and its related industries in Incheon.

First of all, the scope of airport-logistics and its related industries are classified based on previous studies. A theoretical base is then established to build the logistics clusters for the airport-logistics related industries by classifying into the dependent industry and the relevant industry.

Secondly, we suggest the categories of business for the cluster in Incheon: Rail-transportation support service, transportation support service, truck terminal operation service, packing service, the aircraft and its part manufacturing industries and structural steel manufacturing industry.

This study is founded its contributions from the suggestion of 1) the logistics-related industry classified into dependent and relevant industry to build theoretical foundation for forming the air-logistics industry cluster and 2) particular selection framework for building air-logistics industry cluster in Incheon.

Key Words: Air-logistics industry, Selection of business type, business for the cluster, IO model, Incheon

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# I. Introduction

Environmental changes of international economy which can be represented by globalization and open-door policy are stimulating competition to achieve the position of the center for logistics among Asian countries.

This deepening of competition requires not only maintaining existing professional logistics firms and freight demand, but also preparations and efforts to be able to support high value-added logistics activities for attracting production base or local logistics center of global firms into the hinterland of logistics hub such as airport and seaport area.

Specially, the role and possibility of Incheon area as the center of Northeast air-logistics is getting more important since Incheon international airport which was built with highest quality of facilities among Northeast Asian region is located in Incheon area and, Incheon and its vicinity is appointed as Free Economic Zone.

Therefore, it is needed to prepare an appropriate strategy for forming the air-logistics industry cluster to maximize economic effects by attracting logistics business and its related business into Incheon international airport and its hinterland. However, a political analysis for developing the air-logistics industry cluster in Incheon area has not been sufficiently studied.

Hence, the purpose of this study is to define the air-logistics industry and its related industry for choosing the appropriate business types for air-logistics industry cluster in Incheon area and finally suggest particular types of businesses. To achieve this research aim, the direction of this study is suggested by reviewing existing studies which is shown in the section 2.

In the section 3, the air-logistics industry and its related industry are defined to be used for conformity of two different standards of industry classification made by Korea national statistical office and bank of Korea.

By doing this, the base of further research progress will be prepared. At last, section 4 shows the result of selection by analyzing of import and export items and input-output analysis. The detail list of selected types of businesses that might be suitable to be included in air-logistics industry cluster in Incheon area is shown in this section.

# II. Literature Review

Literature review explains why airport hinterland needs to attract air-logistics industries and to be cluster through international studies and also reviews what types of businesses would be attracted into airport hinterland through Korean studies.

## 1. International studies

Haezendonck[1] may be the first scholar to use the term "port cluster".which she defines as :

"The set of interdependent firms engaged in port related activities, located within the same port region and possibly with similar strategies leading to competitive advantage and characterized by a joint competitive position vis-a-vis the environment external to the cluster."

The history and quantity of research on industry cluster of airport hinterland is not long and deficient. Nonetheless, there is no doubt that the concept of airport cluster will contribute to the development of greater economic activities for those companies associated within it.[2]

Hoen[3] defined the importance of leader industries as "strategic centers with superior co-ordination skills and the ability to steer change".

## 2. Korean studies

### 1) Review of studies in attracting industry into airport hinterland

Incheon International Airport Corporation[4] chose the business type that is expected to increase export volume since China joined to WTO. The detailed business types are computer, semiconductor, communication equipment, household electrical appliances, motor and so on.

Korea Institute for Industrial Economics and Trade[5] selected business type basis on international company's investment decision and the possibility to be invested. The selected business types in this study are electric and electronic, pharmacy, medical equipments, transportation equipments, metal goods, precision chemicals, general machinery, precision machinery, optical instruments, groceries and so on. In addition, the business types that were chosen according to small quantity with high

1 Haezendonck, E.(2001), p.7.
2 De Langen, P. W.(2004), pp.18~36.
3 Heon(2001).
4 Incheon International Airport Corporation(2001), pp.20~35.
5 Korea Institute for Industrial Economics and Trade(2003), p.37.

value-added, competitiveness of SCM and the production base in Korea, are computer, medical equipments, optical instruments, fashion clothes, and sports goods.

Incheon Development Institution[6] suggested the business type of communication equipments, sounds facilities, semiconductor, motor parts and medical supplies according to their selection criteria of high value-added, high-reliability technique and high space efficiency.

**2) Review of studies on air-logistics industry cluster**

You[7] suggested the appropriate types of businesses for building airport-focused logistics cluster in the Incheon Free Economy Zone. The selection criteria are as follows; 1) industry cluster that usually use air transport for trading, 2) suitable industry for attracting FDI, 3) industry considering SCM of multinational corporations and 4) industry that has correlation with logistics industry. The summary of this research result is shown in <Table 1>.

<Table 1> Selected business types of air-logistics cluster

| Criteria | Trading | FDI concern | SCM concern | Total |
|---|---|---|---|---|
| Appropriate Industries | Electric& Electron Machinery Precision Machine Precious Metal | Electron Communication Equipment, Optical Medical Instrument, General Machinery, Chemical Products | Fashion clothes, Compute, Sports goods Optical instrument Pharmacy, Toy Manufacturing & Distribution | Electric&Electron Parts, Medical Optical Precision Instruments, Pharmacy&Chemical Products, Machinery Parts |

Park[8] analyzed the data of trading results, FDI and global supply chain to choose the appropriate business types. The selected businesses are electric and electronic parts, medical optical precision instruments, pharmacy and chemical goods, machinery parts and so on. He also estimated an economic effect(effect of added-value and employment generation) of successful case by using IO and MRIO model.

6 Incheon Development Institution(2005), pp.20~35.
7 You, G. H. (2003), pp.185~207.
8 Park, Y. H. (2006), pp.7~19.

### 3. Summary of literature review

The particularly international studies about logistics industry cluster are limited to introducing concepts and scenarios rather than suggesting specific types of businesses which might be suitable to be included in the cluster.

Existing Korean researches that studied what types of businesses will be attracted into airport hinterland laid too much emphasis on manufacturing industry, excluding logistics industries, focusing on selecting main businesses by various criterion into cluster rather than establishing conceptual model and reviewing by related analysis.

Therefore, this study suggests conceptual model of air logistics industries which is classified into dependent industry and relevant industry and then particular types of businesses of the air-logistics industry and its related industry(dependent industry/relevant industry) for the purpose of establishing the air-logistics industry cluster in Incheon.

The study make clear a radical difference with suggesting specific types of businesses and considering manufacturing and logistics industry simultaneously to establish the air-logistics industry cluster in Incheon, against results derived from the previous studies.

## III. Scope of Research

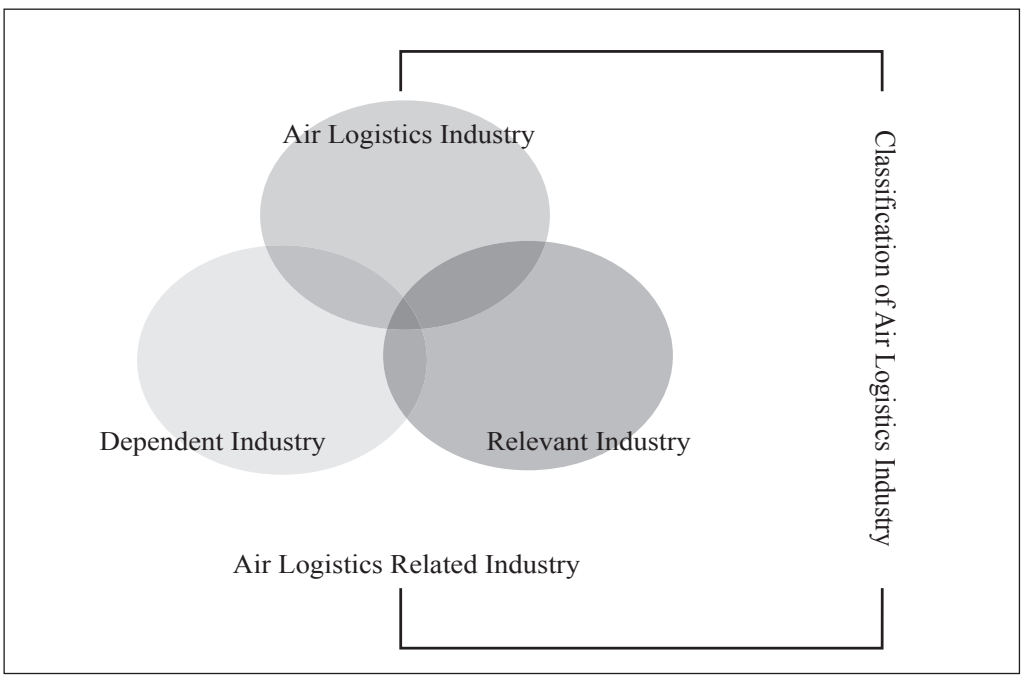
There is no consistent way to distinguish between logistics industry and air-logistics industry. It can be varied in terms of purpose of analysis and researcher's view point. In this study, we classified air-logistics related industry into two-industry; air-logistics-dependent industry(dependent industry) and air-logistics-relevant industry(relevant industry).

First of all, dependent industry of air-logistics related industry is defined that the location of this industry is influenced by location of airport and seaport, and businesses which have large amount of exports and quantity of goods transported are selected from among the businesses that are purchasing raw materials and importing and exporting through the airport and seaport.

Relevant industry of air-logistics related industry is defined that it is also influenced by location of airport and seaport, and the business that has high amount of funds and volume of business is selected from among the businesses that have a relationship of purchasing or selling with logistics industry.

As mentioned above, this study classified logistics related businesses that are influenced by choosing location of airport and seaport, into dependent and relevant industry. This can be illustrated as shown in <Figure 1>.

<Fig. 1> Range of logistics industry




These industries are influenced not only the location decision but also economic activities by airport and seaport. Therefore, it is important to understand how much businesses are depending on airport and seaport for developing an industry cluster around airport and seaport. In this study, the business type in dependent industry is selected by analyzing export and import trading data and the business type in relevant industry is selected by input-output analysis.

As a precedent work, the job to accord two different industry classifications, standard industry classification from Korea national statistical office and input-output table from bank of Korea, has been carried out. The final result of this work is shown in <Table 2>.

## <Table 2> Conformity of Industry classification for Air-logistics business type selection

| Classification | Industry Classification from Bank of Korea | | Standard Industry Classification from Korea National Statistical Office | | | | |
|---|---|---|---|---|---|---|---|
| | Index | Biz Type | M | S | XS | XXS | Biz Type |
| Manufacture of Transportation | 283 | Truck | 34 | | | | Manufacture of Motor Vehicles, Trailers and Semitrailers |
| | | | | 341 | | | Manufacture of Motor Vehicles and Engines for Motor Vehicles |
| | | | | | 3411 | | Manufacture of Engines for Motor Vehicles |
| | | | | | | 34110 | Manufacture of Engines for Motor Vehicles |
| | | | | | 3412 | | Manufacture of Motor Vehicles |
| | | | | | | 34122 | Manufacture of Motor Vehicles for the Transport of Goods |
| | 292 | Aircraft | 35 | | | | Manufacture of Other Transport Equipment |
| | | | | 353 | | | Manufacture of Aircraft, Spacecraft and its Parts |
| | | | | | 3531 | | Manufacture of Aircraft, Spacecraft and its Assistant Equipment |
| | | | | | | 35310 | Manufacture of Aircraft, Spacecraft and its Assistant Equipment |
| | | | | | 3532 | | Manufacture of Engines and Parts for Aircraft |
| | | | | | | 35321 | Manufacture of Engines for Aircraft |
| | | | | | | 35322 | Manufacture of Aircraft Parts and Accessories |
| Facility | 321 | Airport facility | 63 | | | | Supporting and Auxiliary Transport Activities ; Activities of Travel Agencies |
| | | | | 639 | | | Other Services Allied to Transport Agency |
| | | | | | 6393 | | Supporting Air Transport Activities |
| | | | | | | 63931 | Airport Operation |
| Transportation | 334 | Railway | 60 | | | | Land Transport ; Transport Via Pipelines |
| | | | | 601 | | | Interurban Rail Transportation |
| | | | | | 6010 | | Interurban Rail Transportation |
| | | | | | | 60100 | Interurban Rail Transportation |
| | 336 | Road | 60 | | | | Land Transport ; Transport Via Pipelines |
| | | | | 603 | | | Road Freight Transport |
| | | | | | 6031 | | Freight Trucking |
| | | | | | | 60311 | General Freight Trucking |
| | | | | | | 60312 | Freight Trucking By Small Truck and Self Management |
| | | | | | 6032 | | Other Road Freight Transport |
| | | | | | | 60320 | Other Road Freight Transport |
| | 339 | Air | 62 | | | | Air Transport |
| | | | | 621 | | | Scheduled Air Transport |
| | | | | | 6210 | | Scheduled Air Transport |
| | | | | | | 62100 | Scheduled Air Transport |
| | | | | 622 | | | Non-Scheduled Air Transport and Airplane Rental with Operator |
| | | | | | 6220 | | Non-Scheduled Air Transport and Airplane Rental with Operator |
| | | | | | | 62200 | Non-Scheduled Air Transport and Airplane Rental with Operator |
| Transport Supporting Service | 340 | Land transport supporting service | 63 | | | | Supporting and Auxiliary Transport Activities ; Activities of Travel Agencies |
| | | | | 639 | | | Other Services Allied to Transport Agency |
| | | | | | 6391 | | Other Supporting Land Transport Activities |
| | | | | | | 63911 | Supporting, Railway Transport Activities |
| | | | | | | 63913 | Operation of Freight Terminal Facilities |
| | | | | | | 63919 | Other Supporting Land Transport Activities |
| | 342 | Air transport supporting service | 63 | | | | Supporting and Auxiliary Transport Activities ; Activities of Travel Agencies |
| | | | | 639 | | | Other Services Allied to Transport Agency |
| | | | | | 6393 | | Supporting Air Transport Activities |
| | | | | | | 63939 | Other Supporting Air Transport Activities |
| Handling | 343 | Handling | 63 | | | | Supporting and Auxiliary Transport Activities ; Activities of Travel Agencies |
| | | | | 631 | | | Cargo Handling |
| | | | | | 6310 | | Cargo Handling |
| | | | | | | 63101 | Air Freight and Land Freight Handling |
| Storage | 344 | Storage & Warehousing | 63 | | | | Supporting and Auxiliary Transport Activities ; Activities of Travel Agencies |
| | | | | 632 | | | Warehousing |
| | | | | | 6320 | | Warehousing |
| | | | | | | 63201 | General warehousing |
| | | | | | | 63202 | Refrigerated warehousing |
| | | | | | | 63203 | Farm product warehousing |
| | | | | | | 63204 | Dangerous goods warehousing |
| | | | | | | 63209 | Other warehousing |
| Packing, forwarding | 345 | Other Transport Related Service | 63 | | | | Supporting and Auxiliary Transport Activities ; Activities of Travel Agencies |
| | | | | 639 | | | Other Services Allied to Transport Agency |
| | | | | | 6399 | | Other Supporting Transport Services n.e.c. |
| | | | | | | 63991 | Freight Transport Arrangement |
| | | | | | | 63992 | Packing and Crating |
| | | | | | | 63999 | All Other Supporting Transport Services n.e.c. |

Note : This conformity was performed based on total index table and example shown in standard industry classification from Korea national statistical office, and expert opinion.

The particular selection procedure for 'selection of air-logistics related business type' is described in detail.

Selection of dependent business type is performed firstly by examining 10 import and export items trading with China and top 10 import and export items of Incheon. From these two examinations, major import and export items in Incheon area are selected and the business types that produce these items are estimated (HS code-converting into standard industry classification code). Then, the characteristics of these business types are studied in details.

Selection of relevant business type is performed by factor analysis of producer transaction table of input-output table. By factor analysis, the business type that has large forward and backward linkage effects is founded, and selected business types are matched with business type classification of Korea national statistical office to study their characteristics.

# IV. Analysis Results

## 1. Dependent business type selection by import-export item analysis

To select type of air-logistics-dependent business, 10 import and export items of business with China and top 10 major items that import and export through Incheon airport are examined. Hence, the type of dependent business is selected on interfaced items among them whom produce those examined items.

According to amount of funds and the quantity of goods transported in 2005, major import and export items transported through Incheon airport are as follows; electric and electronic, precision machinery, general machinery and jewellery.

These items, estimated possible dependent type of business that may be suitable to be invited in the hinterland of airport are listed with manufacture of computer, camera and other optical product, semiconductor and other electric parts, communication equipment and broadcast instrument, broadcast receiver and other image and sounds equipment, general purpose machinery, measuring·testing·sailing and other precision-machinery, parts of motor, jewellery/accessary and related product.

<Table 3> Air logistics-dependent business type selection

| Import & export items | Import & export business type |
|---|---|
| Electric & electronic | Computer Manufacturing |
| | Electric equipment and parts |
| | Semiconductor electronic parts manufacturing |
| Precision Machinery | Sound equipment manufacturing |
| | Precision machinery manufacturing |
| | Manufacture of measuring test sailing and other precision machinery |
| | Communication equipment manufacturing |
| | Optical equipment manufacturing |
| General Machinery | General machinery manufacturing |
| Precious Metal | Jewellery/accessary and related goods manufacturing |

## 2. Relevant business type selection by input-output analysis

### 1) Backward linkage effect

To analyze input structure of air-logistics industry, as shown in <Table 2>, 11 types of air-logistics businesses and 404 part of input-output table have been conducted factor analysis.

The result of factor analysis shows that the value of 'KMO measure of sampling adequacy', which can explain very well the correlation between variable pairs, is greater than 0.6 which is relatively high. Bartlett's test of sphericity, that shows a model compatibility, is suitable to use factor analysis and there could be common factor existed since the null hypothesis (correlation matrix is identity matrix) is rejected.

<Table 4> Test of KMO and Bartlett

| Contents | | Value |
|---|---|---|
| Kaiser-Meyer-Olkin measure of sampling adequacy | | 0.605 |
| Bartlett's test of sphericity | Approximate Chi-square | 6,398 |
| | Degrees of Freedom | 36 |
| | Significant Probability | 0.000 |

As shown in <Table 5>, two-industry clusters are formed in terms of similarity of input structure and these two-industry clusters can explain 64% of information from 9 types of businesses.

<Table 5> Total variance explained

| C* | Initial Eigenvalue | | | Extraction Sums of Squared Loadings | | | Rotation Sums of squared Loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | % Variance | % Cumulative | Total | % Variance | % Cumulative | Total | % Variance | % Cumulative |
| 1 | 4.457 | 49.526 | 49.526 | 4.457 | 49.526 | 49.526 | 4.431 | 49.236 | 49.236 |
| 2 | 1.368 | 15.204 | 64.730 | 1.368 | 15.204 | 64.730 | 1.394 | 15.494 | 64.730 |

*Components

The input structure is divided into two similar industry clusters by rotated component matrix. It shows that railway transport, road transport, handling, storage and warehousing and other transport related services are in the same group, and aircraft, air transport, land and air transport supporting service are in the same group.

In addition, as communality is extracted by factor analysis, the reflected rate of information from individual business type can be found by communality. In the analysis of air logistics industry, the reflected rate of information of railway transport, road transport, handling and other transport related service is the highest, while the reflected rate of land transport supporting service's is the lowest.

<Table 6> Rotated component matrix

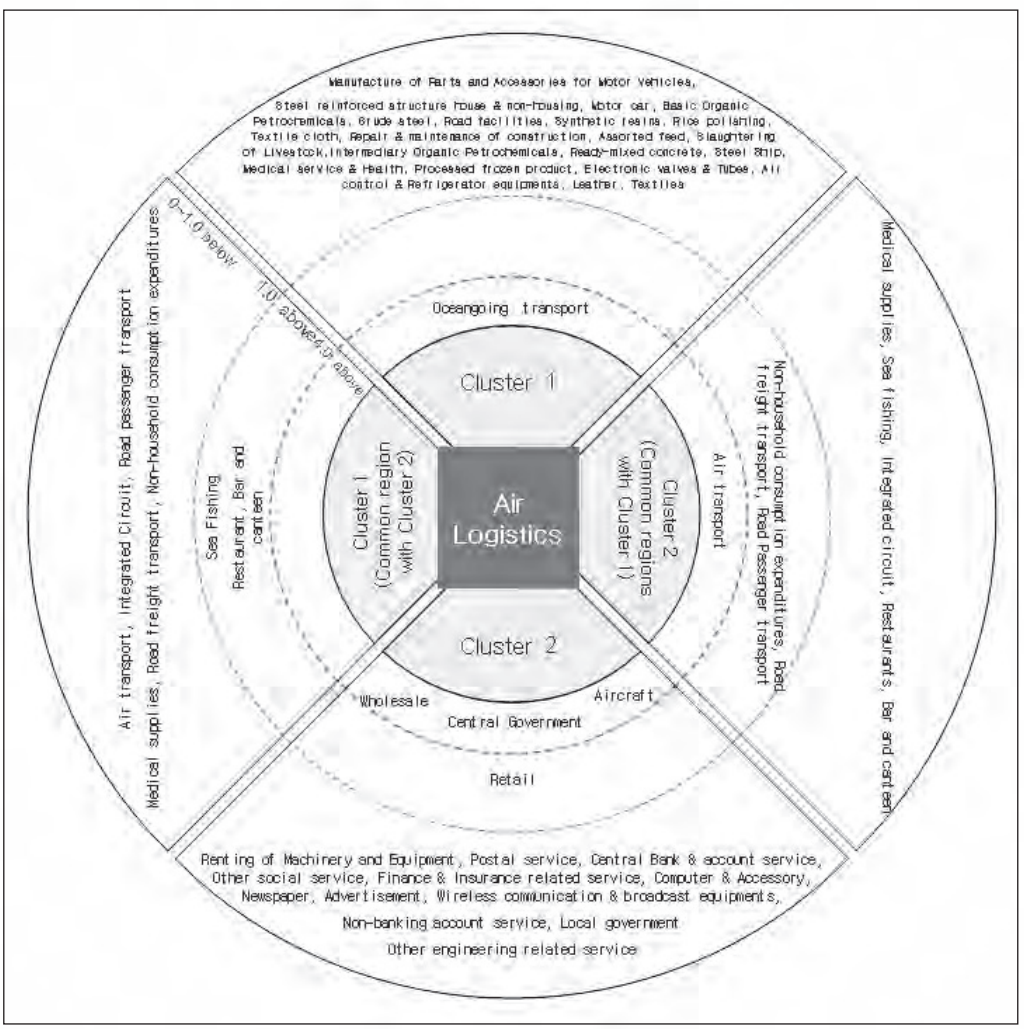
| Business type of Air -logistics industry | Communality | Component | |
|---|---|---|---|
| | | Land related logistics | Air related log istics |
| Aircraft | 0.598 | -0.021 | 0.773 |
| Railway transport | 0.957 | 0.978 | -0.025 |
| Road transport | 0.919 | 0.957 | 0.053 |
| Air transport | 0.433 | 0.007 | 0.465 |
| Land transport supporting service | 0.316 | 0.027 | 0.393 |
| Air transport supporting service | 0.616 | 0.042 | 0.784 |
| Handling | 0.963 | 0.981 | 0.011 |
| Storage & Warehousing | 0.671 | 0.813 | 0.106 |
| Other transport supporting service | 0.953 | 0.966 | 0.143 |

Note : PCA(Principle Component Analysis) was used for extracting factor and Kaiser's normal varimax was used for rotation in factor analysis. Freight truck and air transport facility were excluded since these businesses have relatively small impact on other businesses and difficulties of fractioning into component.

The analysis result shows that both air-transport and aircraft have very high backward linkage relationship in air-logistics industry, and road transport also has backward linkage relationship. In other industry, oceangoing freight transport, sea fishing, restaurants, road passenger transport and central government have high backward linkage relationship.

Additionally, as communality is extracted by factor analysis, the reflected rate of information from individual business type can be found by communality. In the analysis of air logistics industry, the reflected rate of Railway transport, Handling, Other transport supporting service and Road transport are highly reflected.

<Fig. 2> Effect of backward linkage business in the air-logistics industry



### 2) Forward linkage effect

To analyze output structure of air-logistics industry, similar to input structure, 11 types of air-logistics businesses and 404 part of input-output table have been conducted factor analysis.

The result of factor analysis shows that the value of 'KMO measure of sampling adequacy' which can explain very well the correlation between variable pairs, is greater than 0.6 which is relatively high. Bartlett's test of sphericity that shows a model compatibility is suitable to use factor analysis and there could be common factor existed since the null hypothesis (correlation matrix is identity matrix) is rejected.

<Table 7> Test of KMO and Bartlett

| Contents | | Value |
|---|---|---|
| Kaiser-Meyer-Olkin measure of sampling adequacy | | 0.616 |
| Bartlett's Test of Sphericity | Approximate Chi-square | 1,803 |
| | Degrees of Freedom | 45 |
| | Significant Probability | 0.000 |

As shown in <Table 8>, three-industry clusters are formed in terms of similarity of output structure and these three-industry clusters can explain 64% of information from 10 types of businesses.

<Table 8> Total variance explained

| Component | Initial Eigenvalue | | | Extraction Sums of Squared Loadings | | | Rotation Sums of squared Loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | % Variance | % Cumulative | Total | % Variance | % Cumulative | Total | % Variance | % Cumulative |
| 1 | 3.692 | 36.923 | 36.923 | 3.692 | 36.923 | 36.923 | 2.964 | 29.637 | 29.637 |
| 2 | 1.451 | 14.513 | 51.436 | 1.451 | 14.513 | 51.436 | 1.844 | 18.444 | 48.081 |
| 3 | 1.324 | 13.237 | 74.732 | 1.324 | 13.237 | 64.673 | 1.659 | 16.592 | 64.673 |

The output structure is divided into two similar industry clusters by rotated component matrix. It shows that aircraft, air transport, air transport supporting services and road transport supporting services are in the industry cluster of air related logistics and storage and warehousing, other transportation related service, handling, railway freight transport, road freight transport are in the industry cluster of land related logistics.

Additionally, as communality is extracted by factor analysis, the reflected rate of information from individual business type can be found by communality. In the analysis of air logistics industry, the reflected rate of information of air transport, air transport supporting services, storage and warehousing are highly reflected.

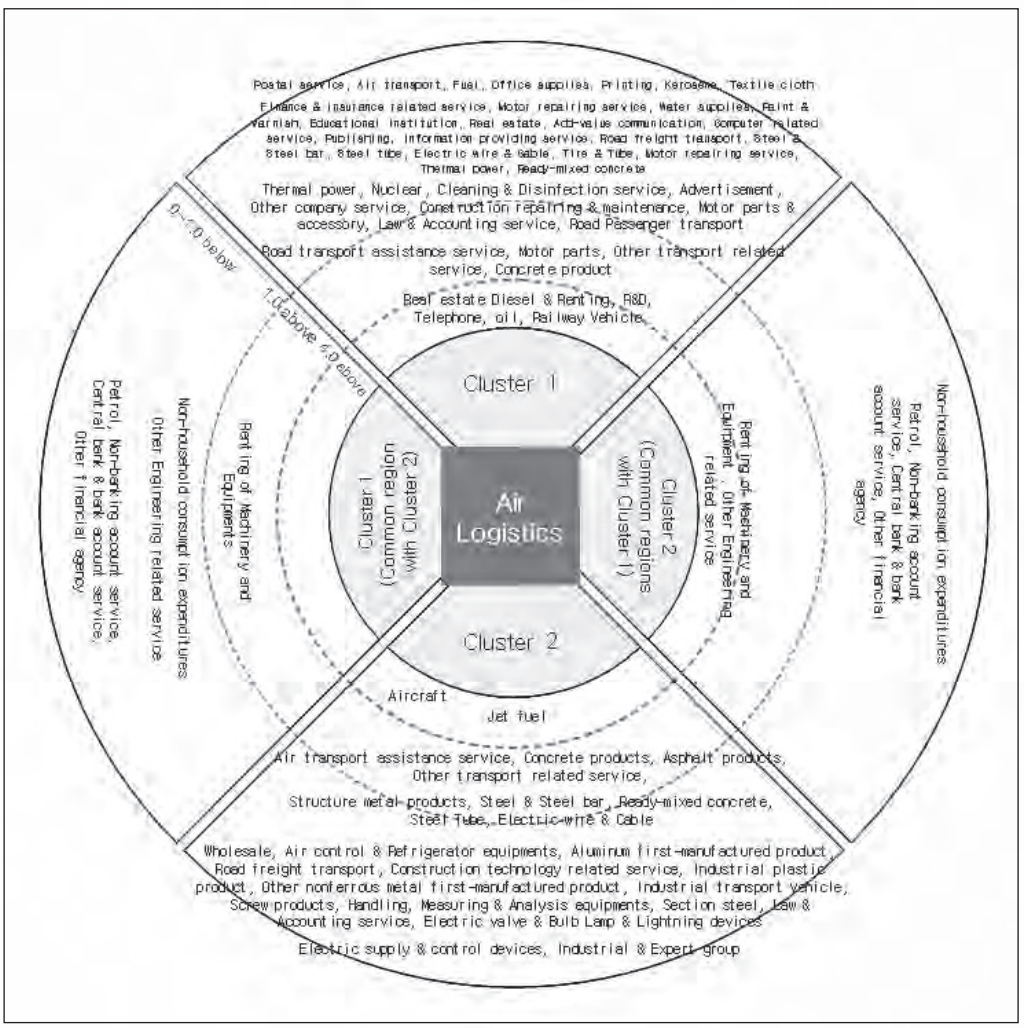
<Table 9> Rotated component matrix

| Business type of maritime logistics industry | Communality | Component | |
|---|---|---|---|
| | | Land related logistics | Air related logistics |
| Aircraft | 0.321 | 0.060 | 0.441 |
| Railway freight transport | 0.386 | 0.532 | -0.005 |
| Load freight transport | 0.351 | 0.512 | 0.068 |
| Air transport | 0.706 | 0.053 | 0.838 |
| Land transport supporting service | 0.594 | 0.035 | 0.743 |
| Air transport supporting service | 0.757 | 0.163 | 0.850 |
| Handling | 0.665 | 0.646 | 0.231 |
| Storage and warehousing | 0.826 | 0.878 | 0.186 |
| Other transport related service | 0.683 | 0.824 | 0.054 |

Note : PCA(Principle Component Analysis) was used for extracting factor and Kaiser's normal varimax was used for rotation in factor analysis. Freight truck and air transport facility were excluded since these businesses have relatively small impact on other businesses and difficulties of fractioning into component.

The analysis result shows that water transport supporting services, land transport supporting services, other transport related services and aircraft have very high forward linkage relationship in the air logistics industry. In other industry, diesel oil, structure metal product, machinery equipment and renting, petrol, other engineering related service, non-banking account service, central bank and account service, railway vehicle, structure metal products, asphalt products, concrete products, ready-mixed concrete, non-cast iron or steel, electric wire and cable, road passenger transport and motor parts have high backward linkage relationship.

<Fig. 3> Effect of forward linkage business in the air-logistics industry




## 3. Analysis of industry location characteristics of Incheon

The location characteristics of Incheon area can be studied by matching dependent business type selected from import and export items, and forward and backward relevant business type selected from factor analysis with business types shown in standard industry classification table from Korea national statistical office.

Comparing location characteristics of dependent business in Incheon with Seoul, the result shows that manufacturing companies that produce computer and precious metal have relatively low number of company establishments and workers.

In terms of business type, relative importance of number of company establishments for computer manufacturing and workers are shown 4% and 0%, respectively. For precious metal product, relative importance of number of company establishments and workers are given 1% and 2%, respectively.

Comparing number of company establishments and workers in Incheon with Seoul, the relative importance of road passenger transport, wholesale, central government, aircraft, retail, sea fishing, restaurants, construction maintenance, structure metal product, machinery equipment, and renting, other engineering related service, ready-mixed concrete, law and accounting services, realestate rental service, asphalt product, land transport supporting service, telephone, cleaning and disinfect service, concrete product and aircraft manufacturing is very low compared to country's overall figure.

## 4. Selection and allocation of strategic business types

For the growth of Incheon airport and seaport, it will be needed to build a logistics cluster around hinterland of airport and seaport and free trade zone. In further, it is required to locate logistics industry, logistics related industry and supporting institution within cluster region and build a network for interrelationship.

The region where the key functions of logistics is implemented with Incheon airport is assigned as a core of cluster. The region where the services and strategic businesses to support key functions of logistics are located is assigned as a first-order central hinterland. Lastly, the region where all related manufacturing firms are located is assigned as a second-order central hinterland. With these three defined regions, logistics industry, dependent business types and relevant business types can be assigned properly as shown in.

Selected business types can be investigated in terms of location characteristics of Incheon area and whether selected business types overlap with dependent and relevant business, forward and backward linkage effects and regional strategic industry.

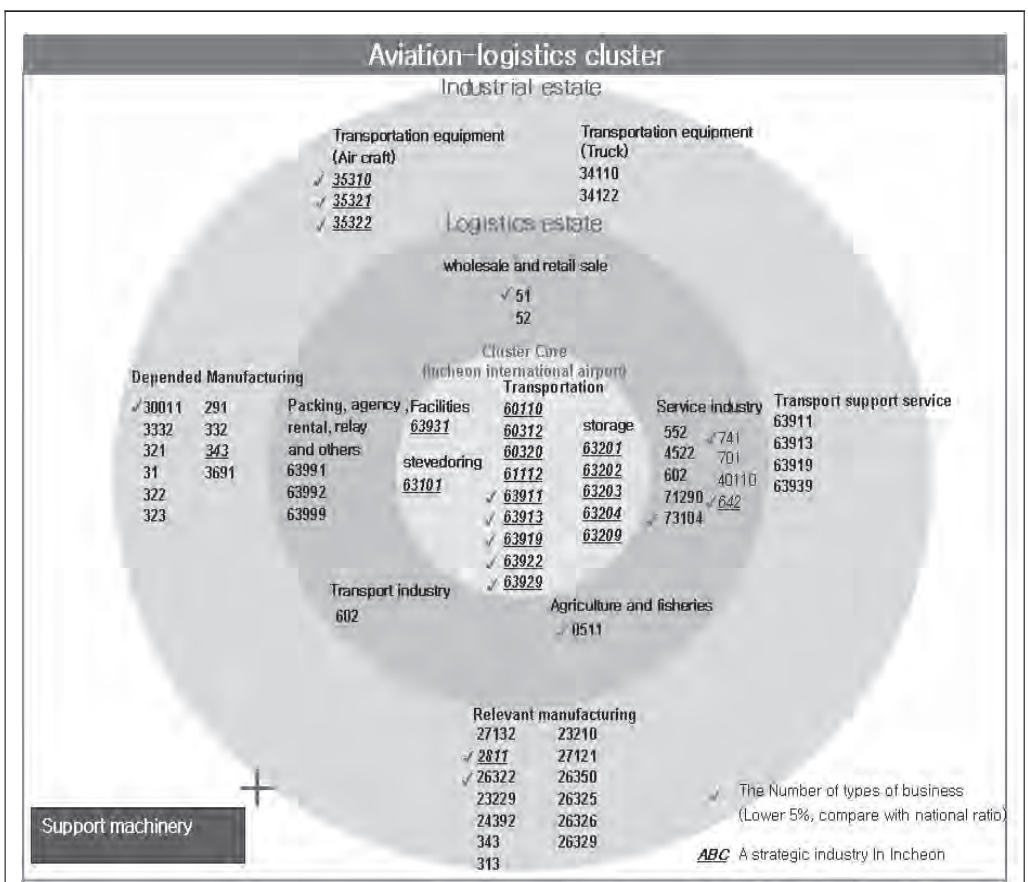
Firstly, the business that is airport-dependent so that frequently import and export by air transportation and has a large both forward linkage effect and backward linkage effect in the air-logistics industry is found motor parts manufacturing.

Secondly, among relevant business types in the air logistics industry, air transport, road transport, aircraft·spacecraft and parts manufacturing and other transport related services are found that they give an impact on both forward and backward linkage.

In the third place, among the business types that must be included in the cluster, the business type that has less than 5% of relative importance in the number of company establishments in Incheon versus overall country data is found computer manufacturing, motor parts manufacturing, aircraft, spacecraft and its parts manufacturing, other transport related services, wholesale and retail, sea fishing, electric communication, law and accounting service, structure metal product, ready-mixed concrete manufacturing and engineering and R&D.

Finally, overlapped business types with Incheon's strategic business types are air transport, road transport, aircraft·spacecraft and its parts manufacturing, other transport related service, structural metal products and motor parts manufacturing.

<Fig. 4> Strategic selection and allocation for building air-logistics cluster



| | | | |
|---|---|---|---|
| 0511 | Sea Fishing | 3411 | Manufacture of Engines for Motor Vehicles |
| 2321 | Petroleum Refineries | 34122 | Manufacture of Motor Vehicles for the Transport of Goods |
| 23229 | Reprocessing of Other Fractionated Petroleum | 3531 | Manufacture of Aircraft, Spacecraft and its Assistant Equipment |
| 24392 | Manufacture of Essential Oils and related Products | 35321 | Manufacture of Engines for Aircraft |
| 26322 | Manufacture of Ready-Mix Concrete | 35322 | Manufacture of Aircraft Parts and Accessories |
| 26325 | Manufacture of Hot Rolled. Drawn and Extruded Iron or Steel Product | 601 | Interurban Rail Transportation |
| 26326 | Manufacture of Concrete Pipes, structural Components and Other Concrete Products for Civil Engineering | 60311 | General Freight Trucking |
| 26329 | Manufacture of Other Concrete Products n.e.c. | 60312 | Freight Trucking By Small Truck and Self-Management |
| 27121 | Manufacture of Hot Rolled, Drawn and Extruded Iron or Steel Products | 6032 | Other Road Freight Transport |
| 27132 | Manufacture of Pipes and Tubes, of Non-cast Iron or Steel | 61112 | Oceangoing foreign freight transport |
| 2811 | Manufacture of Structural Metal Products | 621 | Scheduled Air Transport |
| 291 | Manufacture of General Purpose Machinery | 622 | Non-scheduled Air Transport |
| 30011 | Manufacture of Computer | 63101 | Air Freight and Land Freight Handling |
| 31 | Manufacture of Electrical Machinery and Apparatuseses n.e.c. | 63201 | General warehousing |
| 321 | Manufacture of Semiconductor and Other Electronic Components | 63202 | Refrigerated Warehousing |
| 322 | Communication equipments & broadcast equipments manufacturing | 63203 | Farm Products Warehousing |
| 341 | Manufacture of Parts and Accessories for Motor Vehicles and Engines | 63209 | Other Warehousing |
| 3332 | Manufacture of Photographic Equipment and Other Optical Instruments | 63911 | Supporting, Railway Transport Activities |
| 343 | Manufacture of Parts and Accessories for Motor Vehicles and Engines | 63913 | Operation of Freight Terminal Facilities |
| 3691 | Manufacture of Jewellery and Related Articles | 63919 | Other Supporting Land Transport Activities |
| 4011 | Electric Power Generation | 63931 | Airport Operation |
| 4522 | Non-Residential Building Construction | 63939 | Other Supporting Air Transport Activities |
| 51 | Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles | 63991 | Freight Transport Arrangement |
| 52 | Retail Trade | 63992 | Packing and Crating |
| 552 | Restaurants, Bars and Canteens | 63999 | All Other Supporting Transport Services n.e.c. |
| 602 | Transit and Ground Passenger Transportation | | |
| 352 | Manufacture of Railway and Tramway Locomotives and Rolling Stock | | |
| 642 | Telecommunications | | |
| 701 | Real Estate Activities with Own or Leased Property | | |
| 7129 | Renting of Other Machinery and Equipment | | |
| 73104 | Research and Experimental Development On Engineering and Technique | | |
| 741 | Legal, Accounting and Tax Preparation Services | | |
| 323 | Manufacture of Television and Radio Receivers, Sound or Video Recording or Reproducing Apparatuses, and Related Goods | 63204 | Dangerous Goods Warehousing |

## 5. Fostering plan of strategic type of business

The types of businesses that can be considered as crucial fostering businesses for Incheon are overlapped with regional strategic industry and has significantly low relative importance for number of company establishments compared to overall country data. These businesses can be invited to Incheon logistics cluster in the near future. The particular business type is included in an industry classification of 'Other Services Allied to Transport Agency(639)' such as aircraft chartering and sale, aircraft repairing and maintenance & assembling, and aircraft parts. It is needed to develop these businesses since world airport market is experiencing a consistent increase in airfreight demand, passenger demand and aircraft demand as the world agreed to open sky policy. From this point of view, if Incheon is able to attract the global firm that is doing business with aircraft chartering and sale related service, Incheon international airport will become a hub airport in Northeast Asia and this will stimulate activation of financial market that is related to aircraft intermediary so as to give the positive impact on the economy of Incheon.

# V. Conclusion

The aim of this study is to carry out intensive fostering plan of air-logistics and its related types of businesses to strengthen logistics industry's competitiveness in Incheon area and build the air-logistics industry cluster of logistics business and related business to maximize its impact on regional economy.

The results of this study can be summarized. Firstly, the scope of logistics industry and logistics-related industry has been defined based on literature reviews and theoretical background. The logistics-related industry is classified into dependent and relevant industry so as to build theoretical foundation for forming the air-logistics industry cluster.

Secondly, even though the strategic types of businesses that will be invited to air-logistics industry cluster have high dependent effect with airport and seaport and linkage effect among industries (also these are matched with Incheon's strategic industries), it is needed to select the types of businesses that have low relative importance of number of company establishments and workers among whom are located in Incheon. The detailed list of these businesses are supporting service of railway transportation activities,

operation of freight terminal facilities, other supporting land transport activities and packing service. And these businesses that in manufacture industry are manufacture of aircraft·spacecraft and auxiliary equipment, aircraft engine, aircraft parts and structural metal product.

This study defined air-logistics industry classified into relevant business and dependent business by analyzing economic effects of air-logistics. Then, based on this, fostering plan of logistics industry cluster was suggested. However, it has limitations that input-output model of Incheon is not existed yet and the code of industry classification made by bank of Korean and Korea national statistical office are different. Thus, it is difficult to precisely analyze economic effects of air-logistics industry that affect on economy of Incheon.

This study is founded its contributions from the suggestion of 1) analysis scheme of dependency and linkage of air-logistics industry and other industries and 2) particular selection framework for building air-logistics industry cluster in Incheon.*

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